uBooNE Reconstruction - Task #13469

Milestone # 13399 (New): Parent reconstruction milestones/tasks for reconstruction necessary for MCC8 and reconstruction "v6"

Milestone # 13400 (New): MCC8 and "v6" reconstruction development

Milestone # 13406 (New): Vertex Reconstruction

Task # 13428 (New): Vertex Reconstruction - Pandora tasks

Creation and refinement of vertex candidates

08/08/2016 07:22 AM - John Marshall

Status:	New	**Start date:**	08/08/2016
Priority:	Normal	**Due date:**	10/01/2016
Assignee:	Joris De vries	**% Done:**	60%
Category:		**Estimated time:**	0.00 hour
Target version:			

Description

Current status: proof-of-principle code that creates 3D candidate Vertices based on 2D Cluster topologies and also, new and quite conservatively, based on locations where energy depositions change significantly. He clusters groups of Vertex candidates and applies new selection criteria to determine which candidates to put forward to the Hit-based scoring

History

#1 - 08/22/2016 09:31 AM - Joris De vries

This task consists of two main elements. First of all, it was noticed that there is room for additional types of vertex candidates. Currently, vertex candidates are created by projecting 2D cluster endpoints onto clusters in different views. This simple method has turned out to be very effective, but in some cases does not create vertices near the true interaction vertex.

For this reason I have added vertex candidates that are based on where 2D clusters cross in each view. 2D clusters are extrapolated in each view, and the 2D positions where they cross are matched between views. These crossing candidates are effective at recovering events in which the 2D clusters are incomplete for any reason. In addition, an energy-based vertex method has been added that very conservatively places a vertex candidate at points where the hit energy deposition changes dramatically within a single cluster. These vertex candidates can recover events in which back to back muon and proton clusters have been merged together.

The second part of this task is to change the way vertex candidates are presented to the vertex scoring procedure. Our previous vertex scoring algorithm functioned by creating various 'scores', which indicated how good a certain vertex candidate was. These scores, depending on how they were weighted, tended to favour vertex candidates in certain regions of the event, causing crucial feature points in the event to be overlooked. For this reason, I am working on an approach where the vertices are clustered into 'vertex clusters', which are then ranked. One can then consider the best vertex in each vertex cluster: in this way one takes all feature points into consideration. This method proves to be extremely effective at reducing the vertex selection problem from selecting the best vertex from several hundred candidates to selecting the best vertex from, for instance, 5 pre-selected vertex candidates.

Extensive testing of the new vertex candidate types (crossing and energy-based candidates) show that they recover a number of events in several identified failure modes. Refinement and testing of the vertex clustering method has shown that it is highly effective at simplifying the vertex selection problem. By continuing to develop these methods and by modifying the vertex selection procedure to take these changes into account, significant improvements to the Pandora vertex reconstruction procedure can be achieved.

#2 - 11/04/2016 11:12 AM - John Marshall

- % Done changed from 0 to 60

Joris hand-scanned CCQE events with large vertex 3D deltaR. Motivated need for additional candidate positions. Candidates are put forward to the Vertex selection algorithm.
Sample 2D Cluster along sliding linear fit and extrapolate fit at either end of Cluster, then find 2D Cluster crossing points. If crossing points in two views are at common x, can provide 3D Vertex.

Associated pattern recognition performance shown at MicroBooNE collaboration meeting.